

ART. XXVIII.—*Morphology of the Vermiform Appendix.*<sup>1</sup>

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[With Plates LXVI.-LXXVA.]

Since Owen's time, but more particularly during recent years, comparative anatomy applied to the vermiform appendix has been in a state of retrogression. This fact is marked by the disappearance from current literature of description of the vermiform appendix of the wombat. (Fig 1.)

Owen, by his great ability, the possession of John Hunter's collection and the friendship of the Prince Consort, was able to employ comparative anatomy effectively. Until late in life, Owen was unhampered by religious controversy. When Huxley crushed the opposition of Owen to the law of evolution a serious setback to comparative anatomy was unconsciously given, Owen being at that time the authority on that branch of science. Thus comparative anatomy, upon which the law of evolution is largely based, became neglected on the acceptance of that law.

Since Owen's time those who have written on the comparative anatomy of the appendix have confused minute structure with shape. The work of Owen and Treves, because of its great intrinsic worth, deserves close study. The comparative anatomy

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<sup>1</sup> The work was done in the Veterinary Research Institute, University of Melbourne, and in the Zoological Gardens, Melbourne.

in Kelly's great work on the appendix is very inaccurate. Mitchell's work on the digestive tract is riddled with error, especially his remarks on the wombat. Mitchell denies that the wombat has a true vermiform appendix. He says the wombat has two avian caeca, one of which has been mistaken for the vermiform appendix. After making this amazing statement, Mitchell says he has never seen a wombat caecum, but he has seen a drawing of a wombat's caecum by Flower.

The vermiform appendix is a peculiar caecal shape which occurs only in mammals. (Fig. 2.) To extend the study of the appendix into birds is therefore futile. Mitchell has carried the avian double caecum into mammalian work in the wombat to his own confusion. After extended observations on the caeca of many varieties of birds, we see nothing in them throwing any light on the mammalian appendix. Caecal size varies greatly in different varieties of birds; for instance, the common laughing jackass (*Dacelo*) of Australia has complete caecal atrophy, the wedge-tailed eagle (*Aquila audax*) and the lyre bird (*Menura victoriae*) each have two atrophic caeca about the size of a rice grain, the cassowary (*Casuarius*) has two caeca about two and a-half inches long. Pheasants, ducks, geese and swans have well-developed caeca. It is interesting to note that the Nankeen night-heron (*Nycticorax*) has a single caecum like a mammal, and that the Indian python has a well-developed single caecum. The monitor (*Varanus*) is particularly interesting because he shows a caecum in the process of formation. These variations of caecal development do not, however, lend themselves so readily to explanation as the caecal variations that occur in mammals, because we know less of the habits of these animals than we know of the habits of mammals.

Since Huxley defeated Owen several facts relative to the appendix, familiar to Owen and described by him, have by later writers been displaced, but by fallacies. (Fig. 3.)

The rabbit in place of the wombat now is regarded by Mitchell as the possessor of a vermiform appendix. What does the word vermiform mean? Worm-like. (Figs. 1, 2, 7.)

Recent work on the appendix has ignored shape and devoted itself unsuccessfully to histological investigation; a result which must always follow when naked-eye anatomy is supplanted by

microscopic anatomy. That which the microscope makes clear is not the form of the tissue-mass from which the section was made, but the histological elements of which the mass is composed.

Years ago Owen saw that the peculiarity of the rabbit's caecum was that lymphoid tissue formed the caecal end. He microscoped it (Fig. 4); he also microscoped the human vermiform appendix (Fig. 5). He described the lymphoid tissue in the rabbit's caecal end as massed lymphoid tissue, while he described the appendix of man as containing less lymphoid tissue. It did not occur to Owen, on account of the presence of this massed lymphoid tissue, to name the end of rabbit's caecum vermiform. Owen did not regard the rabbit as showing that rare form of caecum which he thought of under the name of vermiform appendix.

Lockwood at a later date emphasised the presence of lymphoid tissue in the human appendix. Mitchell, on account of the lymphoid end of the rabbit's caecum, calls it "the vermiform appendix of the rabbit." (Fig. 3.) To quote him, "The rabbit's caecum is capacious and ends, as is well known, in a finger-shaped, narrow, thick-walled vermiform appendix." Since this loose description was adopted all sorts of caecal ends have erroneously been dubbed vermiform. No valid reason has yet appeared for repressing the original meaning of the word vermiform and twisting it to mean digitiform or distorting it to mean lymphoid.

The "abdominal tonsil" theory of the appendix has resulted from confusing things that are distinct in structure and form. Berry and Ellenberger have accepted the lymphoid tissue of the caecum as the agent that compels the vermiform appendix to come into being. To quote Berry, "The vermiform appendix is a part of the alimentary canal specialised for lymphoid function, and not a vestigial remnant."

Lymphoid tissue in an atrophic vermiform appendix should be regarded from many view points before it can be accepted as the causation of the appendix. That this lymphoid tissue is not drawn up and enmeshed in tissues during the recession of the caecum is not yet proven. The basis of lymphoid tissue is round cells. A mass of round cells must assume that shape which

their containing tissues determine; therefore lymphoid cells cannot compel form. The atrophic caecum of the cat has no vermiform appendix. It has as much, or about as much, lymphoid tissue as the human vermiform appendix. (Fig. 6.) The law governing lymphoid tissue must be the same in a cat's caecum as in a man's caecum. As the lymphoid tissue is equal in each case and the shape differs, the statement that lymphoid tissue compels form is denied by the cat's caecum. During recession of the caecum it is quite possible to believe that lymphoid tissue may offer some obstacle to atrophic processes by affording the muscular walls a content grip—a totally different process from the development of the appendix for lymphoid protection. To accept the idea that the appendix develops for the protection of lymphoid tissue in a caecum that has reached an advanced stage of atrophy compels one to believe that a duality of processes (atrophy and hypertrophy), each opposing the other, occurs at the same time in the same caecum.

The pig has a Peyer's patch about six feet long, and yet for the reception of this vast expanse of lymphoid tissue no appendix is developed. One wonders how this mass of lymphoid tissue manages to exist without a vermiform appendix when we are asked to believe that the insignificant amount of lymphoid tissue in the human appendix is the cause of the development of vermiform appendix. If lymphoid tissue compelled the vermiform appendix to develop, the intestinal tract should be studded with vermiform appendices wherever lymphoid tissue occurs. If lymphoid cells compel the shape of the human appendix, they also compel the shape of the wombat's vermiform appendix. The vermiform appendix of the wombat contains no different amount of lymphoid tissue from what is normal to the intestine. We have sectioned the vermiform appendix of three different wombats. In two of these the sections fail to show any lymphoid tissue. Mr. W. Fielder kindly sectioned a wombat's appendix for us; his first sections were like ours, negative. On prolonged search he discovered solitary follicles, a condition which he considers normal to the caecum. (Fig. 18.)

We have been unable to find any test which, applied to the lymphoid tissue of the human appendix, would lead us to believe that lymphoid tissue is the cause of the development of the

vermiform appendix. We strongly believe that an appendix cannot develop, but that it results as a vestige marking recession from a larger caecum.

Direct comparison of the rabbit's caecum with man's caecum is impossible, because there is a vast difference between the caecal evolution of man and the caecal evolution of the rabbit. A comparison of the rabbit's caecum with man's caecum is as great an absurdity as a comparison of man's brain with a rabbit's brain.

Before caecal comparison can be made, a satisfactory basis of comparison must be established. The basis of caecal comparison must be the relationship in caecal development which the compared animals bear to their respective natural orders. The rabbit, among the rodents, is distinguished by enormous caecal development. (Fig. 3.) Man, among the primates, manifests atrophic caecal recession. (Fig. 2.) No primate shows an enormous caecal development at all comparable with the enormous caecal development of the rodent rabbit. Among the marsupials we find the koala (Fig. 19) with enormous caecal development. Therefore we believe the rabbit and the koala are fit animals for direct comparison. The koala and the rabbit each have the mucous membrane of their caeca raised in ridges for the purpose of absorption; neither caecum is sacculated by muscle bands.

The rabbit's caecum and the koala's caecum are both enormous organs, but differ in that the koala's caecum shows no lymphoid gland at the caecal end. Therefore in orderly comparison the rabbit gland turns out to be an arrangement not common, but casual to great caecal development, a glandular arrangement casual to that stage of caecal evolution.

Although the rabbit's caecum cannot be directly compared with the caecum of a primate, it is possible to institute mediate comparison by finding a rodent animal in the same stage of caecal evolution as some primate animal. The viscacha and the beaver-rat are sufficiently near the lemur (Fig. 11) to make comparison between rodents and primates possible. Neither the end of the caecum of the viscacha nor the caecal end of the beaver-rat show the lymphoid gland which is observed in the end of the rabbit's caecum. Therefore this lymphoid gland of

the rabbit is lost in procession through the rodent order. With such knowledge it is futile to pursue the investigation of the rabbit gland further. It is entirely illegitimate to believe that the rabbit's caecal lymphoid gland should make its appearance in the vestigial vermiform appendix of man or of the wombat.

Neither in external appearance nor in structure is there a likeness between the vermiform appendix of the wombat (Fig. 7) and the caecal end of the rabbit. Anatomists cannot accept each of these animals as the possessors of vermiform appendices unless they deprive the word of all sense and meaning.

A likeness has been seen by Mitchell in working out the lymphoid theory between the caecal end of the rabbit and the vermiform appendix. The lymphoid gland in the rabbit's caecal end causes such an upheaval of the mucous membrane that the lumen of the caecal end of the rabbit becomes narrowed to such an extent that its digestive function is reduced to a minimum or altogether ceases. On opening a rabbit's caecum this area of caecum is often found empty of ingesta, whilst the remainder of the caecum is distended with ingesta. The sole likeness of the rabbit's caecal end to the vermiform appendix lies in the fact that both canals are narrowed in the lumen and consequently are of little account as digestive organs. In evolutionary changes the rabbit is remotely removed from that stage of caecal involution at which a vermiform appendix becomes possible. (Fig. 8. B.) If lymphoid tissue is to take the place of shape in naming the end of the caecum, the rabbit's caecal end represents the truest type of vermiform appendix. The vermiform appendix was named before any thought was given to its contained lymphoid tissue. Since histologists mistook lymphoid cells for shape the rabbit's caecal end has been erroneously called a vermiform appendix.

*The shape of the appendix depends on the muscular wall of the caecum, the outstanding cause being the external longitudinal muscle coat arranged in bands over what is regarded as the caecum, and in a sheath or sac over that part of the caecum which is called the vermiform appendix. (Figs. 2 and 7.)*

Surgeons guide themselves to the appendix by following the longitudinal muscle bands. Morphologists must, in order to understand the force which compels the characteristic shape of the appendix, also follow the longitudinal muscle bands.

On the large intestines the longitudinal muscle bands are about half the length of the entire gut (man). From the shortening that these bands produce the sacculations of the bowels result. These bands commence at the setting on of the appendix from which point they diverge on to the caecum and thence to the colon. The external muscle coat can be profitably studied with the use of Treves' classical "four types of caecum." (Fig. 8.)

*Type A* is a cone-shaped caecum which Deaver calls infantile. It represents about two per cent. of the caeca of the civilised races. This *A type* is a caecum which has not formed an appendix; the muscle bands terminate at the narrowing of the cone into the muscle sheath enveloping the end of the caecum. It is a caecum in the immediately pre-appendicular stage. When the muscle bands that terminate at the narrowing of the cone come into activity, they deliver their pull at a point which becomes the appendicular outlet of the caecum. With the retraction of the caecal muscle bands, the caecum is shortened above the appendix, and with this shortening an increased breadth is established, due to a bellying-out of the circular fibres. Two factors operate to shut off the appendix from active digestive function—the pull of the longitudinal muscles delivered at the junction of appendix and caecum serves to produce a constriction and to shut off the appendix from the caecum proper—the sacculation of the caecum produced by the bellying-out of the circular muscle, assisted in the upright position by gravitation, leaves the appendicular opening as a small hole in a big area of caecal fundus. The caecal fundus does not act as a guide of ingesta to the appendix (Fig. 9); it so acts that food contained within the caecum engages the appendicular opening with great difficulty.

*If the muscle bands continue to the apex of the caecum, as they do in the baboon, no appendix results, because the whole caecum is drawn up and no part shut off from the caecum to form a vermiform appendix* (Fig. 10). The lemur (Fig. 11) represents a type of caecum which, if atrophy continued in that species to the advanced stage shown in man or in the wombat, would develop a caecum carrying a vermiform appendix, providing atrophy continued along the present lines indicated by

the muscle bands and the muscle sheath at the caecal end. The lemur's caecum is much like an enlargement of a combined human type—Treves' type A and a foetal caecum (Fig. 12).

Without going outside the primate order, evidence is forthcoming of two ways in which a caecum may recede from the large to the small, as in man with an appendix and the baboon without an appendix. In the same order the lemur's caecum is that type which may recede and form during that involution a vermiform appendix.

*Treves' B type* which, according to Deaver, represents three per cent. of the human caeca, shows the appendix fully formed in the fundus of the caecum. It should be regarded as the earliest type of appendix. From point of origin the fundus of the caecum, to the ileo-caecal valve, is the range of atrophic take-up brought about by the pull of the mesenteric longitudinal band. Therefore one phase of caecal atrophy, in animals which develop a vermiform appendix, is a line of migration of the appendix from the fundus of the caecum to the lower lip of the ileo-caecal valve, a migration proceeding concurrently with general caecal atrophy. Before complete atrophy of the appendicular caecum can occur, the appendix must remain anchored to the ileo-caecal valve for a time which cannot, in our state of knowledge, be stated. Before that point can be approached, we must discover either a wombat or a man in which complete atrophy of the appendicular caecum has occurred. We do not think that the discovery will be made at an early date, because many human caeca are still in the early stages of appendicular evolution and the wombat (Fig. 14) is in a stationary period, his food being subjected to very slight variation. We do not consider loss of the appendix by disease a true atrophic process; at present to approach the question from the standpoint of sepsis is not a method free from solid objection. We have already said that some animals, as the baboon, will lose the caecum without the appearance of a vermiform appendix, if complete atrophy of the caecum be subsequently established in them. Primates as an order do not lend themselves to a complete study of caecal atrophy, because, as far as we know, complete atrophy has not occurred in primates. We must therefore study those changes in an order in which we have unmis-



takable evidence of complete atrophy having occurred. Because complete atrophy of the caecum has occurred in the marsupial order, accompanied by appendicular formation, the Australian order stands alone in value for the comparative study of the caecum.

Briefly considered, marsupials afford three most interesting types:—

- (1) The koala (*Phascolarctus cinereus*) (Fig. 19), with a huge caecum.
- (2) The wombat with a caecum represented by a true vermiform appendix (Fig. 7).
- (3) The Tasmanian devil (*Sarcophilus satanicus* (Fig. 15) without a caecum.

The Carnivora throw a strong sidelight on caecal variations. No muscle bands form on the caecum, consequently caecal atrophy occurs in those animals without the formation of a vermiform appendix. The hyena has fair caecal development.

The mongoose has an atrophic caecum which would show a vermiform appendix had the arrangement of the longitudinal bands been suitable; but it has no vermiform appendix.

The Himalayan bear has no caecum. Thus in the mongoose a small caecum occurs without muscle bands; in the bear caecal atrophy has proceeded to completion. Considering the three orders, Primates, Marsupials and Carnivora, we are able to definitely state that three stages of caecal atrophy are possible.

1.—*With an appendix*, resulting from the external muscle coat forming bands on the caecum, and a muscle sheath on the appendix. (Man, Fig. 2; wombat, Figs. 14, 1, 7.)

2.—*Without an appendix*, the muscle bands terminating at the apex of the caecum. (Fig. 10.) Baboon.

3.—*Without an appendix* and without muscle bands, as in the mongoose or the domestic cat.

*The variations of the external muscle coat explain the infrequency with which caecal atrophy is accompanied by the formation of a vermiform appendix.*

The dog is of great interest because its caecum is distorted by peritoneal adhesions. About the distortion of the dog's caecum and the appendix of man a common cause operates, viz., peritoneal adhesions. As both man and dog are irregular and

erratic feeders, the question arises whether the distortion seen in the dog's caecum and in man's appendix are due to adhesions contracted during varying distensions of the digestive tract which shift these organs into varying positions.

Treves' type C is, perhaps, from an anatomical standpoint, the least important of his types. It represents the commonest type found in man (the normal caecum of Deaver), and thus assumes an importance on that account alone. It represents the migration of the appendix half way between the fundus of the caecum and the ileo-caecal valve, a migration due to the pull of the mesenteric muscle band.

Treves' type D, also Fig. 16 and the caecum of the wombat (Figs. 1 and 7) are alike. In each case the appendix opens on or into the lower lip of the ileo-caecal valve, having been dragged to that position by the pull of the mesenteric muscle band. Under the pull of this band, atrophy on its side is established earlier than on the free side, and the drag of the mesenteric band is transmitted to the colon, which assumes a position mimicing caecum when caecal atrophy becomes extreme. The caecum on the free side atrophies as the sphincteration of the colon eases under the influence of diet of less bulk and greater nutritive power. In the human caecum variations of type D occasion much confusion during surgical operations. These confusing caeca have been under the influence of a preliminary atrophy which has subsequently been subjected to caecal distension. Fig. 13 shows this condition. The point of interest is the U-shaped longitudinal band which offers clear evidence that the colon has been dragged down either by distension or this force plus gravitation.

We have examined a number of Victorian wombats' caeca. (Figs. 1-14.) They all show Treves' D type caecum—the appendix of a small size. A wombat's caecum sent us by Mr. Desmond from South Australia (Fig. 7) is also of Treves' type D: its appendix, however, is about three times the volume of the Victorian's. Perhaps we have an abnormally big appendix from South Australia; perhaps food differences in the two States explain the lesser atrophy shown by the wombat of South Australia. This is a point which should be cleared up. In a paper published in the "Australian Medical Journal" of 20th

August last, the caecal changes due to food were dealt with. It remains for us to point out that although the state of the bowel development depends wholly upon food taken under the process of natural selection, yet when deductions are drawn from comparative anatomy, those deductions must be controlled by a knowledge of the trend of the order. A study of marsupials, for instance, creates the belief that marsupials are more responsive to food change than primates. The extreme atrophy of the caecum in the wombat occurs on a nutritious diet composed wholly of vegetable matter. When we reflect on the fact that the koala nourishes its tissues wholly on gum leaves, we are struck by the wonderful constructive power of the koala's (Fig. 19) intestines, which convert into strong animal tissues that which to other animals is an indigestible poisonous scented fibre. This higher digestive efficiency explains why the wombat shows caecal atrophy upon a diet which, if taken by man, would require a considerably larger caecum than he has now.

The difference between type D, human appendix, and the wombat's appendix is one of distortion. The human appendix being distorted by erratic peritoneal adhesions, the wombat's appendix being straight.

An amendment of Treve's four types of caecum is necessary, because in those types is not included the foetal type, which differs from type A in showing no longitudinal muscle bands.

Preappendicular types—

*Type A*, No. 1—Foetal caecum. No bands. (Fig. 12).

*Type A*, No. 2—Infantile caecum. Banded. (Fig. 8 A).

Appendicular types—

*Type B*—The earliest appendix or fundal appendix. (Fig. 8 B).

*Type C*—The intermediate appendix. (Fig. 8 C).

*Type D*—The late or ileo-caecal appendix. (Fig. 8 D).

The foetal caecum is proportionately bigger than the adult caecum (man).

Foetal measurements (8 months estimated)—

Stomach and small intestines	-	1.04 metres
Caecum	- - - - -	.06 "
Large intestines	- - - - -	.24 "

## Adult measurements (Morris)—

Stomach - - - - -	.30 metres
Small intestines - - - -	8.00 „
Large intestines - - - -	1.40 „
Appendix - - - - -	.10 „
Caecum - - - - -	.66 „

In the adult the proportionate increase of length from foetal type is:—

Stomach and small intestines -	Eight times
Large intestines - - - -	About six times
Caecum and appendix - - -	Less than three times

*In the foetus the caecal ratio is about one to twenty-two; in the adult, about one to sixty-one.*

In studying the five human types we observe that the foetal caecum is a relatively larger organ than an infantile caecum, for this has become shortened by the pull of the muscle bands which are set into the muscle sheath, the sheath which in type B becomes the appendix. From this stage in caecal atrophy the most easily followed atrophic process is that along the mesenteric muscle band. This process enables the appendix to migrate from the fundus of the caecum to the ileo-caecal valve—a migration going on concurrently with general caecal atrophy. Figs. (type B, Fig. 8. and type D, Fig 8.)

The recession of the human caecum from large foetal type to small adult type is marked by a peculiar variation in the external muscle coat through which, by the pull of the muscle bands on the muscle sheath, an appendix is formed.

The five types of human caecum indicate that during modern times caecal atrophy has been progressing at varying speeds, due to sections of the race adopting foods of different bulk. Rapid food changes have occurred concurrently with material progress and increased transportation facilities. Those in type D have been for a long period taking food of small bulk and high nutritive quality; those in type A have remained on the bulkier food of their ancestors or a food more bulky than is used by type D. Type C—the intermediate type—represents the mean of these extremes; it is the common type. Upon the embryological principle “that the higher types pass through stages during their development that are permanent in some

of the forms below them in the scale of evolution," the recession of the caecum from a longer type is established. Those who deny that the appendix is a vestige of a larger ancestral caecum have the weight of embryological evidence again them.

Heisler's embryology says:—"In the third month the appendix has already acquired the form of a slender curved tube projecting from the caecum. At the time of its first appearance and for some weeks later the appendix has the same caliber as the caecum. Subsequently the caecum outstrips the appendix in growth, the latter appearing in the adult stage as a relatively very small tube attached to a much larger caecum."

The claim that is made that the appendix is a development and not a recession is refuted by a macroscopic study of the anatomical types of caecum, by a study of the embryology of the appendix and caecum, and by studying the lines of force that go to determine the appendicular shape. Upon such lines it is quite easy to follow during atrophic processes the formation of the vermiform appendix, but it is not possible to understand the development of an appendix. The vermiform appendix cannot be developed. It can only be formed during recession of the caecum. Development cannot occur because development implies an increased caecal content, and an increased caecal content exerts its force against the fundus of the caecum and not against the appendix. (Fig. 13).

Leaving the subject of caecal changes in man, we will deal with caecal changes in the only order besides primates that has an animal which shows a true vermiform appendix—the marsupial. Outside primates, the only animal that has an appendix is the wombat. (Figs. 1-7.) There are many points of strong resemblance between the wombat and the koala (Fig. 19), for it is highly probable that at an early date they were closely related. The koala took to the gum trees and lived exclusively on gum leaves; the wombat took to the ground and lived on roots and other food less bulky and more nutritious. The history of this change of food is to be seen in the caecum of these animals. The koala has an enormous caecum to digest its gum leaves, the wombat has only a vermiform appendix to represent its caecum; otherwise the digestive tracts of the wombat and the koala are alike. The Victorian wombat (*Phascolomys*

mitchelli), Fig. 1, has a small appendix and complete atrophy of the remainder of the caecum. With this complete atrophy the muscle bands on the colon have become faint or they have disappeared from view. The wombat sent from South Australia (*Phascolomys latifrons*), Fig. 7, has a larger appendix than the Victorian (Fig. 1), and the caecal atrophy is less complete; muscular bands are well shown on the colon, Fig. 7.

Measurements—

	Caecum	Verm. appen.	Stomach	Colon	Sm. intestine
<i>Koala</i> - -	2.30	—	.35	3.80	1.07
<i>Wombat (young)</i>					
<i>P. mitchelli</i> -	.02?	.012?	.08	.65	1.73
<i>Wombat (adult)</i>					
<i>P. mitchelli</i> -	.05?	.05	.50	5.60	3.27

In the Koala the ratio of stomach to small intestine is

Stomach - - -	0.35
Small intestines - -	2.07

or rather less than one-sixth.

In the Wombat the ratio of stomach to small intestines is

Stomach - - -	0.50
Small intestine - -	3.27

or about one-sixth.

In the koala the ratio of large bowel to small bowel is 2.30, plus 3.8, equals 6.10 of large bowel upon 2.07 of small bowel, which roughly represents a preponderance of large gut over small of 3 to 1.

In the wombat the large bowel is 5.65, the small 3.27, or, roughly,  $1\frac{1}{2}$  to 1. This represents the ratio of large bowel atrophy which has occurred in the wombat.

Fig. 20 is an infantile wombat caecum. Its measurements were made before we had worked out the forces of appendicular formation, and we consider that these caecal measurements demand support by measurements of further specimens before we consider them acceptable. We shall therefore refuse to be guided by the figures indicated by a query. It is quite clear, however, that during the formation of the appendix in the wombat the caecum as a functioning intestinal organ has been lost by atrophic changes.

The Tasmanian devil, having no cellulose to digest, and taking

a carnivorous food, has only 1.9 metres of stomach and intestinal tract. (Fig. 15.)

*Generalisation and Summary.* In Keen's surgery we read: "It is an established fact that appendicitis is more prevalent in some families than in others. On the other hand certain families seem to have complete immunity against the disease. Lucas Champonnier, 1904, analysing 22,000 patients among Roumanian peasants, found but one case of appendicitis; they live mostly on vegetables. The Roumanians in the city, chiefly on animal diet, are frequently affected, one case of appendicitis among every 221 patients. The vegetarian diet of the Japanese and the Indians in India seems to protect them against appendicitis. The absence of appendicitis among the Arabs living in tribes and on vegetables, with its prevalence among those in cities where meat is the chief diet, has already been spoken of."

These observations agree with widespread medical opinion; it does not necessarily follow that they are wholly correct. The Zulus are great meat eaters. South African surgeons should settle the point whether Zulus are often attacked with appendicitis. We are inclined to the idea that appendicitis is as rare amongst Zulus as amongst other savages; the Zulu on his meat diet is built on athletic lines, the Indian coolie on his rice food is a miserable specimen of humanity compared with the robust Zulu. It seems to us that the meat theory of appendicitis is not firmly established, and widespread scientific investigation of the influence of food on bowel structure is required.

When such careful investigation is made, we believe that instead of blaming meat alone for causing appendicitis no special food will be blamed; but that it will be shown that any food of small bulk and high nutritive quality if taken by an animal used to a bulkier food containing cellulose for a long period, causes atrophy from disuse of the caecum. After studying many forms of intestines it becomes impossible to escape the belief that the function of the bowels dominates their development. Comparative anatomy is waiting for the establishment of the anatomical types of caecum that prevail among the races of mankind.

The wombat, being the only animal outside the Primates showing a vermiform appendix, lends a peculiar Australian interest to the study of the morphology of the vermiform appendix. The wombat completely refutes the theory that the

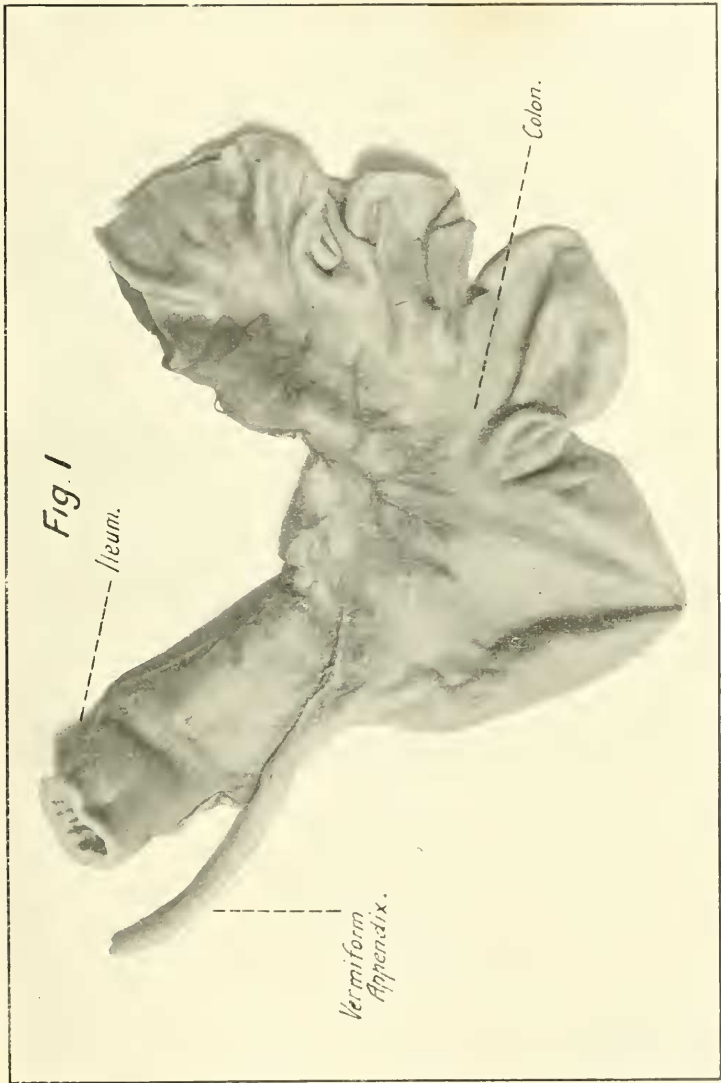


Fig. 1

Ileum.

Colon.

Vermiform  
Appendix.